Manual therapy combined with exercise for chronic neck pain evidence clinical effectiveness and patient outcomes

Arun Verma[1*], Deepak Kumar[2], Rajni Joshi[3], Rekha Kothiyal[4], Himanshu Singhal[5]

*[*1]PhD Physiotherapy, MD & Chief Consultant, Aarogya Physiotherapy Clinic & Rehabilitation Centre, Bhoranj, Hamirpur, Himachal Pradesh, India*
[2]Associate Professor, Department of Physiotherapy, Ras Bihari Bose Subharti University, Dehradun, Uttarakhand, India
[3]Assistant Professor, Doon PG Paramedical College, Dehradun, Uttarakhand, India
[4]PhD Scholar, Ras Bihari Bose Subharti University, Dehradun, Uttarakhand, India
[5]Assistant Professor, Faculty of Pharmacy, Tantia University, Sri Ganganagar, Rajasthan, India

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Abstract:
Chronic neck pain is a common musculoskeletal disorder that can result in persistent pain, restricted cervical mobility, impaired muscle performance, activity limitations, work-related disability, sleep disturbances, and reduced quality of life. Despite the availability of numerous conservative treatment options, its management remains complex because clinical symptoms are influenced by an interplay of physical, psychological, occupational, and behavioural factors. Manual therapy and therapeutic exercise constitute important components of physiotherapy-based management. Manual therapy encompasses cervical and thoracic mobilization, manipulation, soft-tissue techniques, and selected neurodynamic interventions, whereas exercise-based rehabilitation includes strengthening, motor-control training, endurance conditioning, stretching, mobility exercises, postural correction, and functional training. Contemporary evidence increasingly supports combining these approaches, with manual therapy primarily contributing to short-term symptom modulation and movement facilitation, while therapeutic exercise promotes restoration of physical capacity, functional independence, and long-term self-management. Evidence from systematic reviews and clinical trials suggests that combined manual therapy and exercise may improve pain and disability more effectively than exercise alone in selected individuals, although comparisons with manual therapy alone have produced less consistent findings. Strengthening, motor-control, endurance, and mind-body exercise approaches have each demonstrated potential benefits for chronic nonspecific neck pain, without clear evidence that a single exercise modality is universally superior. Treatment outcomes are influenced by appropriate clinical assessment, patient selection, intervention dosage, progression, adherence, education, and individualized rehabilitation planning. This review summarizes contemporary evidence on the integration of manual therapy and exercise for chronic neck pain, with emphasis on proposed mechanisms, comparative effectiveness, pain and disability outcomes, cervical mobility, muscle performance, sensorimotor control, occupational and functional outcomes, quality of life, safety, clinical assessment, treatment progression, and future research priorities.

Keywords:
Chronic Neck Pain, Manual Therapy, Therapeutic Exercise, Physiotherapy, Cervical Spine, Strengthening Exercise, Motor Control, Mobilization, Manipulation, Pain, Disability, Functional Outcomes, Rehabilitation.

1. Introduction:

Chronic neck pain is a prevalent musculoskeletal disorder and a frequent reason for seeking physiotherapy and rehabilitation services. Its development and persistence are influenced by multiple interacting factors, including mechanical and occupational loading, cervical muscle dysfunction, altered movement strategies,

reduced physical capacity, psychological stress, sleep disturbances, and behavioural responses to pain. In contrast to acute episodes that often resolve spontaneously, chronic neck pain may persist for several months or longer and can substantially affect physical activity, occupational participation, social engagement, sleep, and overall quality of life. The clinical presentation is highly variable, ranging from localized cervical pain, stiffness, and restricted movement to associated headaches, shoulder-region symptoms, radiating discomfort, muscle fatigue, dizziness, and difficulty tolerating sustained postures or repetitive activities. Because of this clinical heterogeneity, the assessment and management of chronic neck pain should extend beyond pain intensity alone. A comprehensive approach should consider cervical mobility, muscle strength and endurance, sensorimotor function, movement coordination, functional limitations, occupational requirements, psychosocial contributors, sleep, physical activity, and the individual's expectations and treatment goals. Contemporary clinical practice increasingly emphasizes active rehabilitation, patient education, exercise, and appropriately selected manual therapy rather than prolonged dependence on passive interventions. The 2017 revision of the neck pain clinical practice guideline supports treatment selection according to clinical presentation and emphasizes multimodal strategies for individuals with persistent neck pain. Manual therapy and therapeutic exercise are commonly incorporated into physiotherapy-based management. Manual therapy may involve cervical and thoracic mobilization, manipulation, soft-tissue techniques, traction-related procedures, and selected neurodynamic interventions. Therapeutic exercise encompasses cervical and scapular strengthening, endurance training, motor-control exercises, range-of-motion activities, stretching, proprioceptive and sensorimotor training, aerobic conditioning, postural exercises, and functional rehabilitation. These interventions target different but complementary aspects of the condition. Manual therapy may produce short-term improvements in pain, mobility, stiffness, and movement tolerance, potentially facilitating participation in active rehabilitation. Exercise, in comparison, provides an opportunity to progressively address muscle performance, endurance, motor control, physical capacity, movement confidence, functional tolerance, and long-term self-management. The rationale for integrating manual therapy with exercise therefore extends beyond simply combining two treatment modalities. Manual therapy may be used strategically to reduce symptoms and facilitate movement, while exercise provides progressive loading and functional adaptation. Education and self-management further support treatment adherence and encourage patients to develop strategies for maintaining physical activity and managing recurrent symptoms. This integrated model is particularly relevant to chronic neck pain, where persistent symptoms may involve a combination of physical impairments, altered movement behaviour, reduced activity, and psychosocial influences. Evidence from recent systematic reviews and meta-analyses supports the potential value of combining manual therapy and exercise. A 2023 systematic review and meta-analysis of 22 studies reported that combined manual therapy and exercise produced greater improvements in pain and disability than exercise alone in individuals with nonspecific neck pain, although the certainty of evidence varied across outcomes and comparisons. In contrast, the analysis did not identify significant differences between combined manual therapy plus exercise and manual therapy alone for pain or disability. These findings suggest that combination therapy should not be interpreted as universally superior simply because it contains multiple interventions. Instead, the clinical value of each component may depend on appropriate patient selection, treatment dosage, progression, adherence, and the specific impairments being addressed. The contemporary management of chronic neck pain is therefore shifting from a predominantly passive treatment model toward an integrated rehabilitation framework that emphasizes active participation and individualized care. Manual therapy can be incorporated as an adjunct for symptom modulation and movement facilitation, while therapeutic exercise serves as a central strategy for restoring physical capacity and functional performance. Within this framework, education, self-management, behavioural strategies, and progressive functional rehabilitation can further support sustained improvements. The interaction between pain, cervical mobility, muscle performance, sensorimotor control, psychosocial influences, and rehabilitation interventions is illustrated in Figure 1.

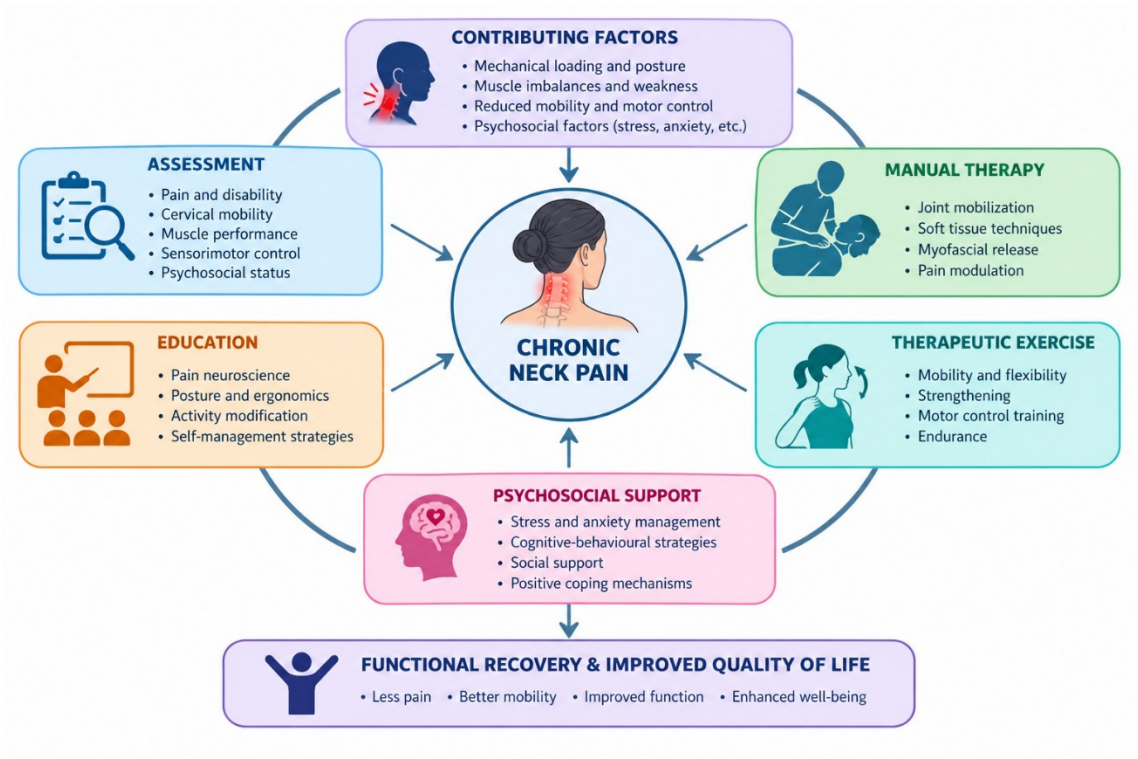


Figure. 1: Integrated rehabilitation framework for chronic neck pain

2. Epidemiology and Clinical Burden of Chronic Neck Pain:

Neck pain represents a major global musculoskeletal health problem. Persistent symptoms may result in repeated healthcare utilization, reduced productivity, work absenteeism, decreased physical activity, and limitations in household and recreational activities. The transition from acute to chronic symptoms is influenced by multiple factors. Although tissue-related mechanisms can contribute to pain, persistence is frequently associated with reduced activity, fear of movement, poor sleep, psychological distress, occupational exposure, and inadequate physical capacity. Chronic neck pain should therefore be understood using a biopsychosocial framework. A patient with prolonged computer use, for example, may have cervical and scapular muscle fatigue, reduced physical activity, sleep disruption, stress, and increased pain sensitivity. Treating only cervical joint mobility may not address the entire problem. This complexity explains why multimodal physiotherapy is commonly recommended. The therapist must identify modifiable contributors and establish an intervention programme that can be sustained beyond the treatment environment.

3. Pathophysiological and Biomechanical Considerations:

The cervical spine provides mobility while simultaneously supporting the head and protecting neural structures. Its functional demands are therefore substantial. Cervical movement depends on coordinated activity of the deep and superficial neck muscles, scapular stabilizers, thoracic musculature, sensory systems, and central nervous system. Individuals with chronic neck pain may demonstrate altered muscle activation, reduced endurance, impaired deep cervical flexor performance, changes in scapular movement, reduced cervical range of motion, and altered movement strategies. However, these findings should not automatically be interpreted as the single cause of pain. Structural and biomechanical findings frequently have imperfect relationships with symptom intensity. Treatment should therefore target impairments that are clinically relevant to the individual rather than attempting to normalize every measurable variable. Exercise can influence several of these systems simultaneously. Strengthening can improve force-generating capacity, endurance training can improve tolerance to sustained activities, motor-control exercises can improve movement coordination, and aerobic exercise may contribute to general physical conditioning and pain-related confidence. Manual therapy may complement these effects by temporarily improving movement tolerance and reducing symptom-related restriction.

4. Manual Therapy in Chronic Neck Pain:

Manual therapy encompasses a broad range of hands-on interventions. Common approaches include cervical mobilization, thoracic mobilization, cervical manipulation, soft-tissue techniques, muscle-energy procedures, traction-related approaches, and neurodynamic mobilization. Mobilization generally involves passive

oscillatory or sustained movement of a joint within a controlled range. Manipulation typically involves a high-velocity, low-amplitude movement. Soft-tissue interventions target muscles and connective tissues, whereas neurodynamic techniques aim to influence the mechanical and physiological behaviour of neural tissues. Manual therapy is frequently used to reduce pain and improve movement. The mechanisms are likely to be multifactorial and may include peripheral mechanical effects, neurophysiological modulation, altered sensory input, changes in pain perception, and changes in movement confidence. A 2024 umbrella review of 35 systematic reviews found evidence supporting manual therapy, particularly when combined with exercise, for nonspecific neck pain. The review also reported evidence for manual therapy approaches in cervical radiculopathy and cervicogenic headache, although confidence varied between conditions and interventions. Figure 2 shows proposed mechanisms through which manual therapy may influence chronic neck pain, including mechanical, sensory, neurophysiological, movement-related, and psychological pathways. Manual therapy should therefore be viewed as one component of a broader rehabilitation programme rather than as a standalone cure for chronic neck pain.

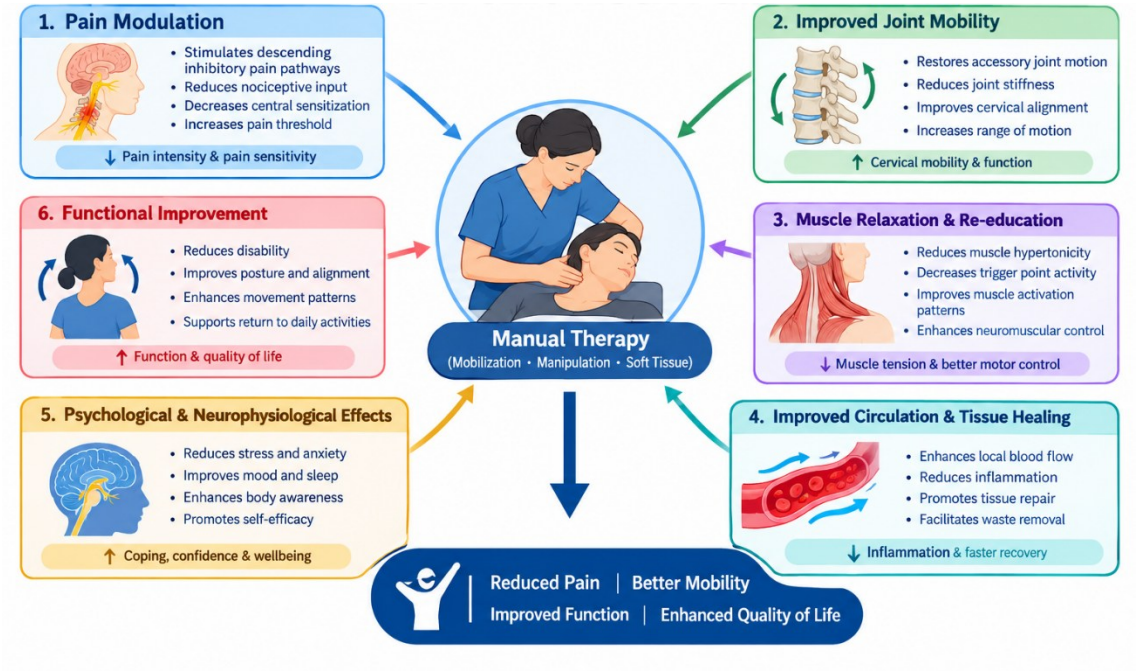


Figure. 2: Mechanisms of manual therapy in chronic neck pain

5. Therapeutic Exercise in Chronic Neck Pain:

Therapeutic exercise is central to modern physiotherapy management of chronic neck pain. Unlike passive interventions, exercise requires active participation and can produce adaptations in muscle strength, endurance, movement coordination, physical capacity, and confidence. Exercise programmes may include cervical strengthening, deep cervical flexor training, scapular strengthening, postural exercises, resistance training, stretching, range-of-motion exercises, aerobic activity, motor-control training, and functional movement. The choice should be guided by the patient's presentation. An individual with low cervical muscle endurance may benefit from progressive resistance and endurance training, whereas a person with significant movement coordination deficits may require motor-control exercises. A systematic review and meta-analysis of systematic reviews published in 2023 found evidence that several exercise approaches can reduce pain and disability in chronic neck pain, while also concluding that there was no clear consensus that one exercise type is universally superior. The most appropriate exercise programme is therefore likely to be the one that can be performed safely, progressively, consistently, and in a manner relevant to the patient's functional goals. Figure 3 shows Exercise-based rehabilitation pathway for chronic neck pain, progressing from mobility and motor-control exercises to cervical and scapular strengthening, endurance training, functional activities, and independent self-management.



Figure. 3: Exercise-based rehabilitation pathway for chronic neck pain

6. Combined Manual Therapy and Exercise:

The combination of manual therapy and exercise has become a common approach for chronic neck pain. The underlying rationale is that manual therapy can temporarily modify symptoms and facilitate movement, while exercise produces longer-term physical and behavioural adaptations. The 2023 systematic review by Wilhelm et al. examined 22 studies and found that manual therapy plus exercise was more effective than exercise alone for pain and disability. However, the review did not identify a significant advantage over manual therapy alone for pain or disability. Quality-of-life outcomes were also not significantly different between combined therapy and exercise alone. A 2025 systematic review and meta-analysis focusing specifically on chronic nonspecific neck pain also concluded that both manual therapy and therapeutic exercise can be effective, with combination treatment showing promising results, although methodological limitations and risk of bias remained in several included trials. These findings suggest that the clinical value of combination therapy may depend less on simply adding manual therapy to exercise and more on how the interventions are integrated. Manual therapy should be used strategically when it facilitates a meaningful functional goal. For example, a patient with painful cervical rotation may receive mobilization to improve movement tolerance, followed immediately by active cervical rotation, motor-control training, and functional head-turning activities. The passive component therefore becomes a bridge to active rehabilitation.

7. Effects on Pain Intensity:

Pain reduction remains one of the most frequently measured outcomes in chronic neck pain research. Manual therapy may provide short-term pain relief through mechanical and neurophysiological mechanisms, while exercise may influence pain through improvements in physical capacity, movement confidence, psychological responses, and possibly pain modulation. The combination of manual therapy and exercise appears to produce statistically greater pain reduction than exercise alone in several studies. In the 2023 meta-analysis by Wilhelm et al., 16 studies comparing combined manual therapy and exercise with exercise alone showed a significant pooled effect favouring combined treatment. However, the authors noted that the pooled difference did not reach their predefined threshold for clinical meaningfulness. This distinction between statistical and clinical significance is important. A treatment can produce a measurable average reduction in pain without producing a meaningful improvement for every individual. Consequently, clinicians should monitor patient-specific outcomes rather than relying exclusively on group-level evidence. Pain intensity should ideally be assessed alongside disability, functional performance, treatment adherence, sleep, work participation, and patient-defined goals.

8. Effects on Neck Disability:

Pain and disability are closely related but distinct outcomes. A patient may report moderate pain but continue normal activities, whereas another may experience relatively low pain but substantial limitations in work, driving, exercise, or household tasks. The Neck Disability Index is commonly used to evaluate disability associated with neck pain. Other instruments include the Patient-Specific Functional Scale and condition-specific functional questionnaires. Combined manual therapy and exercise appears to improve disability compared with exercise alone in several trials. Wilhelm et al. reported a pooled effect favouring combined treatment for disability, although the certainty of evidence was low for this comparison. The improvement in disability may reflect more than pain reduction. Exercise can improve strength and endurance, while manual

therapy may temporarily facilitate movement. Education and graded exposure can further reduce activity avoidance. Therefore, rehabilitation should target function directly rather than assuming that disability will automatically disappear when pain decreases.

9. Cervical Range of Motion:

Reduced cervical range of motion is a frequent finding in chronic neck pain. Patients may have difficulty rotating the head while driving, looking over the shoulder, maintaining a sustained posture, or performing occupational activities. Manual therapy can produce immediate changes in cervical movement. Mobilization may reduce perceived stiffness and improve movement tolerance. Exercise can reinforce these gains through active movement and strengthening. A key clinical principle is that passive improvements should be converted into active movement. If manual therapy increases cervical rotation, the patient should subsequently perform active rotation, motor-control exercises, and functional head-turning, and task-specific activities. This approach reduces dependence on passive treatment and encourages self-management.

10. Cervical and Scapular Muscle Function

Muscle performance is central to chronic neck pain rehabilitation. Deep cervical flexor dysfunction, reduced endurance, altered activation of superficial neck muscles, and impaired scapular control have been reported in individuals with chronic neck pain. Deep cervical flexor exercises commonly involve low-load activation with emphasis on controlled cranio-cervical movement. As capacity improves, resistance and functional complexity can be increased. Scapular strengthening may involve the lower trapezius, middle trapezius, serratus anterior, and other shoulder-girdle muscles. The objective is not necessarily to maintain a single "ideal" posture but to improve the individual's capacity to tolerate varied positions and movements. Progressive resistance training is particularly important when weakness or low endurance contributes to functional limitation.

11. Motor-Control Exercise:

Motor-control training aims to improve the coordination, timing, and quality of cervical and upper-quarter movement. Rather than focusing exclusively on strength, these exercises emphasize controlled movement and appropriate activation. Motor-control exercises may include cranio-cervical flexion, controlled cervical rotation, head repositioning, scapular movement, proprioceptive tasks, and integration with upper-limb movement. Evidence from network meta-analysis suggests that motor-control exercise can be effective for chronic nonspecific neck pain, although the overall certainty of evidence across exercise categories has been described as very low. Motor-control training may be particularly appropriate during the early-to-middle stages of rehabilitation when patients demonstrate movement coordination deficits.

12. Strength Training and Progressive Resistance Exercise:

Strength training provides an important physiological stimulus for patients with chronic neck pain. Reduced muscle capacity can limit tolerance for occupational and daily activities, particularly those requiring sustained head and upper-limb positioning. Resistance exercises may target cervical extensors and flexors, scapular stabilizers, shoulder muscles, and thoracic musculature. Training should be progressive. Initial exercises may use low resistance and high control, followed by increased resistance as tolerance improves. Progressive resistance training may also have psychological benefits. Successfully increasing exercise load can improve self-efficacy and reduce fear associated with movement. Importantly, strengthening should be individualized. The objective is not maximal strength in every patient but sufficient physical capacity to meet functional demands.

13. Exercise and Pain Processing:

Contemporary pain science recognizes that chronic pain may involve altered sensory processing in addition to local musculoskeletal impairments. Some individuals demonstrate increased sensitivity to mechanical or thermal stimuli, although these findings vary considerably. Exercise may influence pain processing through both peripheral and central mechanisms. However, evidence remains uncertain regarding whether exercise consistently normalizes quantitative sensory testing measures. A 2024 systematic review examining neck-specific exercise and quantitative sensory testing found that evidence for effects on objective pain-processing measures remained limited and uncertain. This finding does not undermine the clinical value of exercise. Instead, it suggests that pain reduction may occur through multiple pathways that cannot be fully captured by laboratory sensory measurements.

14. Manual Therapy as an Adjunct to Active Rehabilitation:

The most clinically useful role of manual therapy may be as an adjunct to active rehabilitation. For example, a patient may experience pain during cervical rotation that limits exercise participation. A therapist may perform appropriate mobilization, reassess movement, and then immediately use the improved tolerance to practice active rotation. Similarly, thoracic mobilization may be followed by thoracic extension exercise, scapular strengthening, and functional reaching. This approach maintains the central role of active rehabilitation while using manual therapy strategically.

Table 1. Common manual therapy and exercise approaches for chronic neck pain and their principal clinical objectives

Intervention	Main target	Potential clinical objective
Cervical mobilization	Cervical mobility/pain	Improve movement tolerance
Thoracic mobilization	Thoracic mobility	Facilitate upper-quarter movement
Soft-tissue techniques	Muscle sensitivity	Short-term symptom modulation
Cervical manipulation	Joint/movement response	Short-term pain and mobility effects
Deep cervical flexor exercise	Motor control/endurance	Improve cervical control
Cervical resistance exercise	Strength	Increase load tolerance
Scapular strengthening	Shoulder-girdle capacity	Improve functional upper-quarter performance
Mobility exercise	Range of motion	Restore active movement
Motor-control training	Coordination	Improve movement quality
Aerobic exercise	General conditioning	Improve physical capacity and self-management

15. Functional Outcomes and Activities of Daily Living:

Clinical effectiveness should ultimately be reflected in improved function. Patients with chronic neck pain may report difficulty with driving, computer work, reading, household activities, lifting, carrying, sleeping, exercise, and recreational activities. A rehabilitation programme should therefore include functional tasks relevant to the individual's lifestyle. For office workers, treatment may incorporate graded tolerance for computer work and movement breaks. For manual workers, strengthening and load-management strategies may be more important. For older adults, treatment may focus on safe head movement, balance, driving-related mobility, and upper-limb activities. Functional outcomes should be assessed throughout rehabilitation rather than only at discharge.

16. Occupational Function and Work Participation:

Chronic neck pain is particularly relevant in occupations involving prolonged sitting, computer use, repetitive upper-limb activity, static head positioning, manual handling, or sustained visual attention. Exercise may increase physical capacity and tolerance to occupational demands. Education can address activity pacing, workstation variation, movement breaks, sleep, and workload management. Manual therapy may provide short-term symptom relief that allows continued participation in rehabilitation and work. However, passive treatment alone is unlikely to address long-term occupational capacity. Work-specific strengthening, graded exposure, ergonomic adaptation, and self-management should therefore be incorporated when appropriate.

17. Quality of Life:

Chronic pain can influence emotional wellbeing, sleep, physical activity, social participation, and overall quality of life. Exercise may improve quality of life by increasing activity and physical confidence, although changes are not always proportional to changes in pain. In the 2023 meta-analysis of combined manual therapy and exercise, no significant difference was found between combined therapy and exercise alone for quality of life, and the evidence was considered relatively strong for that comparison. This suggests that the addition of manual therapy does not necessarily provide additional quality-of-life benefits beyond exercise. Quality of life is influenced by many factors beyond cervical symptoms and therefore may require broader rehabilitation strategies.

18. Psychosocial Factors:

Psychological and behavioural factors can influence chronic neck pain. Fear of movement, pain catastrophizing, stress, anxiety, depression, low self-efficacy, and poor sleep may contribute to persistent symptoms. Physiotherapy should therefore incorporate communication and education. Patients should understand that movement is generally safe when appropriately graded and that temporary symptom fluctuations do not necessarily indicate tissue damage. Exercise provides an opportunity for graded exposure. Patients can progressively perform activities they previously avoided while monitoring symptoms and functional response. Manual therapy may be useful for some individuals, but treatment should avoid creating a belief that the neck is fragile or requires repeated passive correction.

19. Education and Self-Management:

Education is an important component of chronic neck pain rehabilitation. Patients should receive information regarding the nature of chronic musculoskeletal pain, activity modification, exercise, sleep, stress, and strategies for managing symptom fluctuations. Self-management reduces dependence on clinical appointments. A patient who understands how to adjust exercise load during symptom flares can continue rehabilitation more consistently. The therapist should distinguish between appropriate symptom monitoring and excessive fear of symptoms. Mild temporary discomfort during exercise may be acceptable in some patients, whereas severe or progressively worsening symptoms require reassessment.

20. Clinical Assessment:

A comprehensive assessment should include subjective history, pain characteristics, functional limitations, neurological screening, cervical movement, muscle performance, upper-quarter function, and psychosocial considerations. The assessment should also identify red flags. Progressive neurological deficit, significant trauma, systemic illness, unexplained weight loss, severe unremitting pain, constitutional symptoms, or other concerning findings require appropriate medical evaluation. For uncomplicated chronic nonspecific neck pain, assessment should focus on identifying modifiable impairments and functional restrictions. Common outcome measures include:

1. Numerical Pain Rating Scale.
2. Visual Analogue Scale.
3. Neck Disability Index.
4. Patient-Specific Functional Scale.
5. Cervical range-of-motion measurement.
6. Cervical muscle endurance testing.
7. Strength assessment.
8. Quality-of-life questionnaires.
9. Fear-avoidance measures.
10. Work participation measures.

Table. 2: Recommended outcome measures for evaluating manual therapy and exercise in chronic neck pain

Outcome domain	Example measure	Clinical purpose
Pain intensity	NPRS/VAS	Symptom severity
Neck disability	Neck Disability Index	Condition-specific disability
Functional performance	Patient-Specific Functional Scale	Patient-defined function
Cervical mobility	Goniometry/inclinometry	Active movement
Muscle performance	Strength/endurance tests	Physical capacity
Quality of life	SF-36/EQ-5D	General health status
Fear of movement	Tampa Scale of Kinesiophobia	Psychosocial factors
Work function	Work-specific questionnaire	Occupational participation
Treatment response	Global Rating of Change	Patient-perceived improvement

21. Safety of Manual Therapy:

Manual therapy is generally considered safe when appropriately selected and performed by trained clinicians, but adverse events can occur. Cervical manipulation requires particular clinical caution because of the anatomical and vascular structures surrounding the cervical spine. Appropriate screening, informed consent, clinical reasoning, and recognition of contraindications are essential. Patients with suspected serious pathology, significant instability, acute trauma, progressive neurological deficits, or other relevant contraindications should not receive inappropriate manual therapy. The choice between mobilization, manipulation, soft-tissue techniques, and no manual therapy should be individualized.

22. Safety and Progression of Exercise:

Exercise is generally safe and beneficial for chronic neck pain when appropriately prescribed. However, excessive loading, poor technique, inappropriate progression, or failure to consider comorbidities may lead to symptom exacerbation. Exercise should progress gradually according to tolerance. An effective progression can move from low-load control exercises toward resistance training, endurance work, functional activities, and higher-level occupational or recreational tasks. The therapist should monitor both symptom response and functional improvement.

23. Treatment Dosage:

There is no universally accepted optimal dose of combined manual therapy and exercise for chronic neck pain. Research protocols vary considerably in treatment frequency, session duration, intervention intensity, and total treatment period. This variability makes direct comparison difficult. A practical programme may involve supervised sessions combined with a structured home exercise programme. Manual therapy can be concentrated in the early or intermediate phase if it provides meaningful symptom or mobility benefits, while exercise progressively becomes the dominant component. Treatment frequency should be individualized according to severity, functional demands, and access to care, adherence, and response.

Table 3. Suggested clinical progression for integrated manual therapy and exercise rehabilitation

Phase	Primary goal	Manual therapy	Exercise emphasis	Functional focus
Phase 1	Symptom modulation	Selective	Gentle mobility/control	Basic activities
Phase 2	Restore movement	Mobilization as required	Motor control + endurance	Daily activities
Phase 3	Build capacity	As clinically indicated	Progressive resistance	Work-related tasks
Phase 4	Functional restoration	Reduced reliance	Strength + conditioning	Occupational/recreational activity
Phase 5	Self-management	Independent management	Long-term exercise	Prevention and participation

24. Adherence to Exercise:

Exercise effectiveness depends strongly on adherence. Patients may discontinue exercises because of pain, lack of time, boredom, uncertainty about technique, or unrealistic programmes. A smaller number of well-selected exercises may be more effective in practice than a complex programme that the patient cannot sustain. The therapist should explain the purpose of each exercise and connect it to the patient's goals. Progress should be visible. Increasing repetitions, resistance, movement quality, or functional tolerance can reinforce motivation. Technology may also support adherence through reminders, video instruction, digital monitoring, and remote feedback.

25. Home-Based Rehabilitation:

Home exercise is essential for long-term management. A patient who depends entirely on clinic-based treatment may experience temporary improvement without developing independent management skills. Home programmes should be simple, progressive, and adaptable. Examples include cervical mobility, deep cervical flexor activation, scapular strengthening, resistance exercises, thoracic mobility, aerobic activity, and functional practice. The programme should be reviewed regularly to ensure progression rather than allowing the patient to remain indefinitely at the same exercise level.

26. Technology-Assisted Exercise:

Digital rehabilitation has expanded considerably. Smartphone applications, video-based physiotherapy, wearable devices, and tele-rehabilitation can support exercise instruction and monitoring. Digital approaches may be particularly useful for individuals who have difficulty attending frequent clinic sessions. However, remote rehabilitation should not simply reproduce passive instructions. It should provide progression, feedback, education, and monitoring. Wearable devices may eventually allow objective measurement of cervical movement and activity during daily life. Figure 4 shows Technology-supported chronic neck pain rehabilitation model integrating therapist assessment, individualized exercise prescription, digital education, remote monitoring, progression, and long-term self-management.

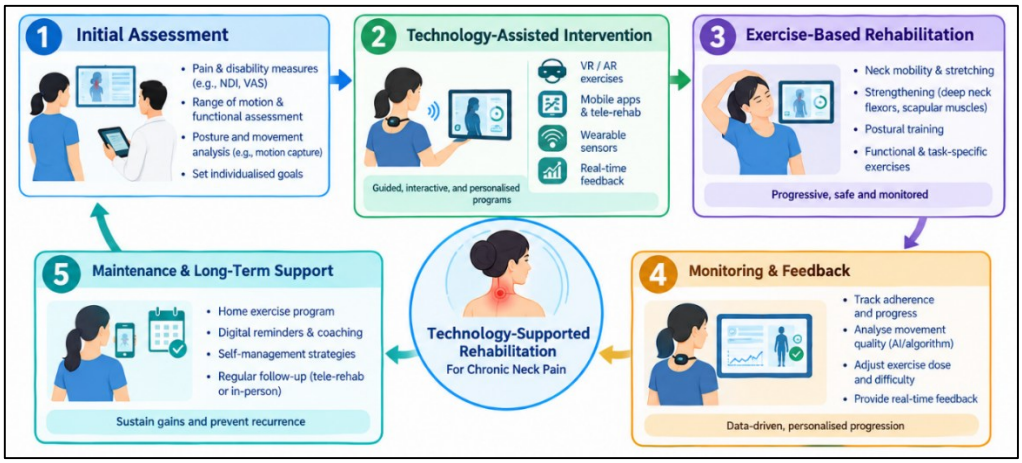


Figure. 4: Technology-supported rehabilitation model for chronic neck pain

27. Manual Therapy and Exercise in Different Clinical Presentations:

Not all chronic neck pain should be treated identically. Patients with nonspecific mechanical neck pain may benefit from exercise and manual therapy directed toward mobility, strength, and functional tolerance. Individuals with cervical radiculopathy may require additional neurological assessment, neural mobilization, cervical and thoracic interventions, strengthening, and education. Evidence from the manual therapy literature supports selected interventions for cervical radiculopathy, but treatment must be guided by neurological findings. Patients with cervicogenic headache may require cervical and thoracic manual therapy combined with targeted exercise. Patients with pronounced psychological distress may require additional education, reassurance, graded activity, and multidisciplinary support. Thus, diagnosis and classification should guide intervention selection.

28. Cervicogenic Headache and Neck Pain:

Cervicogenic headache is associated with dysfunction within the cervical musculoskeletal system and can coexist with neck pain. Manual therapy may be useful for cervical and thoracic mobility, while exercise may address cervical and scapular muscle function. The umbrella review by Riley et al. reported high-confidence evidence supporting manual therapy combined with exercise for cervicogenic headache, although intervention characteristics differed across studies. Clinical management should nevertheless distinguish cervicogenic headache from migraine and other headache disorders because the treatment approach and referral requirements differ.

29. Chronic Neck Pain and Cervical Radiculopathy:

Cervical radiculopathy involves nerve-root-related symptoms and may include radiating pain, paresthesia, weakness, or reflex changes. Patients with neurological signs require careful assessment. Exercise may include strengthening, postural and movement training, and graded functional loading. Manual therapy may include selected cervical or thoracic mobilization, traction-related approaches, and neurodynamic techniques where appropriate. The evidence suggests that manual therapy can contribute to management, but the intervention should be individualized according to neurological status. Progressive neurological deficits or signs suggesting serious pathology require medical assessment rather than routine physiotherapy progression.

30. Comparative Effectiveness of Exercise Types:

One of the important developments in recent literature has been comparison among different exercise approaches. A 2021 network meta-analysis involving 40 randomized controlled trials found evidence

supporting motor-control exercise, strengthening, and mind-body exercise approaches for chronic nonspecific neck pain, while concluding that there was insufficient evidence to establish one exercise approach as universally superior. The 2023 synthesis of systematic reviews similarly found benefits across several exercise categories. These findings support an individualized exercise prescription. A therapist should therefore choose exercises according to impairment, preference, feasibility, and functional goals rather than following a rigid exercise protocol.

31. Clinical Effectiveness of Combined Treatment:

The central question is whether manual therapy adds meaningful benefit to exercise. The current literature provides a nuanced answer. Combined treatment generally performs better than exercise alone for pain and disability in several analyses, but the magnitude of additional benefit may be modest and may not always reach clinically important thresholds. The 2023 meta-analysis found a statistically significant advantage of combined therapy over exercise alone for pain and disability, while finding no significant differences compared with manual therapy alone for pain or disability. The 2025 Cochrane review further examined manual therapy with exercise across acute and chronic neck pain and evaluated pain, function, quality of life, treatment success, and adverse events, reflecting the continuing evolution of the evidence base. Thus, the evidence supports combination therapy as a reasonable component of multimodal rehabilitation but does not justify treating manual therapy as indispensable for every patient.

32. Functional Recovery Rather Than Symptom Elimination:

A major principle of chronic pain rehabilitation is that complete elimination of pain should not always be the only treatment goal. A patient may continue to experience mild intermittent symptoms while returning to work, exercise, social activities, and normal daily life. Treatment success should therefore include:

1. Reduced disability.
2. Improved cervical movement.
3. Increased strength.
4. Greater activity tolerance.
5. Improved confidence.
6. Better work participation.
7. Increased physical activity.
8. Reduced fear of movement.
9. Improved quality of life.
10. Greater independence in self-management.

This broader perspective is particularly important in chronic conditions.

33. Patient-Centred Treatment Planning:

Patient preferences should influence treatment selection. Some patients prefer active exercise, whereas others initially feel more comfortable with hands-on treatment. The therapist can use manual therapy to establish trust and reduce symptoms while progressively emphasizing active rehabilitation. Shared decision-making can improve adherence because the patient understands why each intervention is being used. Goals should be specific and measurable. For example, "reduce pain" is less functional than "work at the computer for two hours with manageable symptoms" or "turn the head comfortably while driving."

34. Practical Integrated Rehabilitation Model:

An effective programme can be conceptualized as a sequence rather than a collection of isolated interventions. The initial stage involves assessment and education. The second stage emphasizes symptom modulation and restoration of basic movement. The third stage progressively develops motor control, strength, and endurance. The fourth stage introduces functional and occupational tasks. The final stage emphasizes independent exercise and long-term self-management. Manual therapy may be used throughout the early and intermediate stages when clinically useful, but reliance should progressively decrease as active capacity improves. Figure 5 shows Integrated manual therapy and exercise pathway for chronic neck pain, progressing from assessment and education through symptom modulation, mobility restoration, motor-control training, progressive strengthening, functional rehabilitation, and long-term self-management.



Figure. 5: Integrated manual therapy and exercise pathway for chronic neck pain

35. Limitations of Current Evidence:

Despite increasing research interest, several limitations remain in the evidence concerning manual therapy and exercise for chronic neck pain. First, treatment protocols are heterogeneous, with substantial variation in the type, intensity, frequency, duration, and dosage of both manual therapy and exercise, making direct comparisons between studies difficult. Second, patients with chronic neck pain represent a clinically diverse population, including individuals with nonspecific mechanical pain, cervical radiculopathy, cervicogenic headache, occupational-related symptoms, and different combinations of physical and psychosocial factors, therefore, findings from one population cannot automatically be generalized to all patients. Third, although several systematic reviews and meta-analyses demonstrate statistically significant improvements in pain and disability with combined manual therapy and exercise, the magnitude of additional benefit over exercise alone is not always clinically meaningful, and the certainty of evidence varies across outcomes. Fourth, many trials have relatively short follow-up periods, limiting conclusions about long-term maintenance of treatment effects and recurrence of symptoms. Fifth, adherence to home exercise programmes is inconsistently reported and may substantially influence clinical outcomes. Sixth, outcome measures vary considerably across studies, with pain, disability, cervical range of motion, strength, quality of life, and functional performance assessed using different instruments and time points. Finally, relatively limited evidence directly evaluates whether improvements observed in clinical measures translate into sustained improvements in occupational performance, community participation, and long-term self-management. Future research should therefore prioritize larger high-quality randomized trials, standardized intervention reporting, longer follow-up, clinically meaningful outcome thresholds, and patient-centred functional outcomes.

36. Future Research Directions:

Future research should investigate the optimal combination and sequencing of manual therapy and exercise. Instead of asking whether manual therapy or exercise is "better," researchers should examine which patients benefit from which combination, at what stage, and at what dosage. Research should also examine treatment responders. Factors such as baseline disability, pain sensitivity, movement limitation, muscle weakness, psychological characteristics, and treatment expectations may influence response. Long-term studies are needed to determine whether combined therapy reduces recurrence and improves sustained participation. Technology represents another important research direction. Wearable sensors could quantify cervical movement, posture variability, and physical activity during daily life. Artificial intelligence may eventually help therapists identify individual movement patterns and prescribe personalized exercise progression, although clinical validation will be essential.

37. Conclusion:

Manual therapy and exercise remain important components of physiotherapy management for chronic neck pain. Contemporary evidence supports an integrated, patient-centred approach rather than exclusive reliance on either passive or active treatment. Manual therapy can provide short-term changes in pain, mobility, and movement tolerance, while therapeutic exercise addresses strength, endurance, motor control, physical capacity, confidence, and long-term self-management. Current systematic reviews indicate that combining manual therapy with exercise can improve pain and disability compared with exercise alone, although the additional benefit is not consistently clinically substantial and outcomes may be similar to manual therapy alone for some measures. Exercise selection should be individualized. Strengthening, motor-control training, mobility exercise, endurance training, and mind-body approaches can all have useful roles, and current evidence does not support a single universally superior exercise programme. The clinical value of manual therapy may be greatest when it facilitates active participation rather than replacing active rehabilitation. A patient who receives mobilization to improve cervical movement should subsequently use that improved

movement during active exercise and functional activities. Long-term success depends on progression, adherence, education, self-management, and functional integration. The therapist should therefore gradually shift the focus from symptom reduction toward restoration of physical capacity and participation. Overall, the most defensible contemporary model for chronic neck pain is a multimodal rehabilitation strategy combining individualized exercise, selective manual therapy, education, behavioural support, and functional progression. Such an approach recognizes that chronic neck pain is not simply a problem of cervical joint mobility or muscle tension but a multidimensional condition requiring restoration of movement, capacity, confidence, and participation.

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